

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Allowed) An X-ray fluorescence system comprising:
an X-ray source;
an X-ray focusing element comprising capillary optics having an input and an output end, the input end in proximity to the X-ray source; and
an aperture disposed on the output end of the focusing element so as to substantially block unfocused halo-producing X-rays, while allowing substantially complete transmission of focused X-rays.
2. (Allowed) A system according to claim 1, the aperture including a substantially X-ray opaque material
3. (Allowed) A system according to claim 1, the aperture including a tapered through opening.
4. (Allowed) A system according to claim 3, the tapered through opening including a larger opening in proximity to the output end of the focusing element.
5. (Allowed) A system according to claim 3, the tapered through opening including a taper angle corresponding substantially to a focus angle of the X-ray focusing element.

Claim 6. (Canceled)

7. (Allowed) An aperture in an X-ray fluorescence system comprising;
a first end;
a second end; and
a passage connecting the first end and the second end, the first end connectable to
an X-ray focusing element comprising capillary optics of the X-ray fluorescence system, the
aperture to substantially block unfocused halo-producing X-rays in the X-ray fluorescence
system.

8. (Allowed) An aperture according to claim 7, the aperture including a
substantially X-ray opaque material.

9. (Allowed) An aperture according to claim 7, wherein the passage is a
tapered passage section with a taper angle corresponding substantially to a focus angle of the X-
ray focusing element.

10. (Allowed) An aperture according to claim 7, the aperture further
comprising an X-ray transparent vacuum seal disposed at the first end or the second end.

Claims 11 – 26 (Canceled)

27. (Currently Amended) An X-ray fluorescence system comprising:
an X-ray element with a first end and a second end;
an aperture disposed on the second end of the element; ~~and~~
a vacuum source connectable to the aperture for evacuating the aperture; and
a sample holder positioned in proximity to the aperture to hold a sample, the
sample maintained at atmospheric pressure.

Claim 28. (Canceled)

Claim 29. (Canceled)

30. (Original) A system according to claim 27, wherein the X-ray element
is an X-ray detector.

31. (Original) A system according to claim 27, wherein the X-ray element
is an X-ray focusing element.

32. (Original) A system according to claim 27, wherein the aperture is
vacuum sealed to the X-ray element.

33. (Original) A system according to claim 27, further comprising an X-
ray source vacuum sealed to the first end of the X-ray element.

34. (Original) A system according to claim 33, further comprising a vacuum source connectable to the X-ray source for evacuating the X-ray source.

35. (Original) A system according to claim 34, wherein the vacuum source connectable to the aperture and the vacuum source connectable to the X-ray source are the same vacuum source.

36. (Allowed) An X-ray path in a microscopic X-ray fluorescence system, the path comprising:

an X-ray source;

an X-ray focusing element comprising capillary optics having an input end and an output end, the input end vacuum sealed to the X-ray source;

a focusing aperture vacuum sealed to the second end of the focusing element so as to substantially block unfocused halo-producing X-rays, while allowing substantially complete transmission of focused X-rays; and

a vacuum source connectable to the X-ray path for evacuating the path.

Claims 37. (Canceled)

38. (Allowed) An X-ray fluorescence system comprising:

a detector for detecting fluorescence from a sample to be irradiated at or around atmospheric conditions; and

an aperture cooperating with the detector to provide an X-ray path, the X-ray path having X-ray transmissive characteristics that differ from atmospheric X-ray transmissive characteristics at or around the fluoresced sample.

39. (Allowed) A system according to claim 38, wherein the system is a microscopic X-ray fluorescence system.

40. (Allowed) A system according to claim 38, wherein the aperture has a tapered conical shape with an X-ray transmissive window.

41. (Allowed) A system according to claim 38, wherein the aperture is vacuum evacuable to thereby provide a vacuum evacuated X-ray path.

42. (Allowed) A system according to claim 38, wherein the aperture is removeable from the detector.

43. (Allowed) A method for detecting elements with low atomic numbers in an X-ray fluorescence system comprising:

positioning a sample for X-ray illumination by the X-ray fluorescence system;

evacuating an X-ray focusing element with a vacuum source;

illuminating the sample with X-rays focused by the X-ray focusing element while the sample remains at atmospheric pressure; and

detecting X-ray fluorescence from the illuminated sample.

44. (Allowed) A method according to claim 43, further comprising evacuating a focusing aperture disposed on an output end of the X-ray focusing element.

45. (Allowed) A method according to claim 43, further comprising evacuating an X-ray source disposed on an input end of the X-ray focusing element.

46. (Allowed) A method according to claim 43, further comprising evacuating an X-ray detector.

47. (Allowed) A method according to claim 46, further comprising evacuating a detector aperture disposed on the X-ray detector.

48. (Allowed) A method according to claim 43, wherein evacuating the X-ray focusing element includes evacuating to less than about 1 milli. Torr.

49. (Allowed) A method according to claim 43, further comprising detecting X-ray fluorescence from elements with atomic numbers above 13.

Claim 50-53. (Canceled)

54. (Allowed) A method according to claim 43, wherein the focusing element comprises capillary optics.

55. (Allowed) An X-ray fluorescence system comprising:

a detector; and

an aperture cooperating with the detector to provide an X-ray path, the X-ray path having X-ray transmissive characteristics that differ from atmospheric X-ray transmissive characteristics,

wherein a gas or gas mixture with a composition different than that of the atmosphere is provided in the X-ray path to provide the transmissive characteristics that differ from atmospheric X-ray transmissive characteristics.